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COMPOUNDS AFFECTING THE REPRODUCTIVE CAPACITY OF THE MEXICAN FRUIT FLY

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During the period from July 1963 to July 1964, inclusive, 153 compounds were studied at the Mexico City laboratory to determine the effect of the compounds on the reproductive capacity of the Mexican fruit fly [Anastrepha ludens (Loew)]. Of these, 20 were found to be effective chemosterilants at various dosage levels.

In primary screening, adult flies were given candidate compounds in a food mixture of orange juice and sugar. The orange juice was prepared by adding three parts water to one part orange-juice crystals and the mixture neutralized with sodium hydroxide. Three cubic centimeters of the neutralized juice was added to 4 grams of granulated sugar and mixed to form a viscous liquid that covered the bottom of a standard petri dish. Enough of the compound was added to the food to provide an initial dose of 1.0 and 0.1 percent. The mixture was allowed to dry for 24 hours and then placed in cages containing 50 pairs of 1-day-old flies. The flies were allowed to feed on the crystalized treated food for the duration of the experiment--an average of 21 days. A dietary supplement of protein hydrolysate (MRT)[2] was included in each cage to obtain maximum egg production. Cages containing untreated food were used as controls. At the end of 1 week and again at 14 and 21 days, each cage was checked for fly mortality. On the 12th and 19th days oviposition medium[3] was placed in the cages, eggs were collected, and 0.01 cc. (approximately 200) were placed in petri dishes on blotting paper discs moistened with a 0.07-percent solution of sodium benzoate to prevent fungal contamination. The eggs were incubated for 7 days and the percent hatch then determined. Compounds that caused sterility or death were retested to determine the effective range of concentration that would induce sterility without excessive mortality. The results with the 20 compounds that affected the reproductive capacity of the flies at one or more concentrations are given in Table 1, under the heading "oral."

Compounds that effectively sterilized either or both of the sexes were tested topically as pupal dips. The test consisted of the technique developed by Shaw and Sanchez Riviello[4]. With this technique the compound was made up in a 5-percent solution and 200 puparia immersed in the liquid for 1 minute. The liquid was then decanted off; the puparia were allowed to dry for 24 hours and then placed in cages to await emergence. Mortality was recorded in terms of the percent emergence of the adults. When the flies were sexually mature (10 to 12 days after emergence), eggs were collected and treated in the manner described above, and the percent hatch determined. Puparia treated with distilled water were used as controls. The results obtained from the 20 compounds previously found to be effective after primary and secondary screenings are given in Table 1, under the heading "topical."

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[1] The authors acknowledge the cooperation of the chemists of the Pesticide Chemicals Research Branch of this Division for procuring the chemical substances studied and in synthesizing some of the compounds used.

On the basis of both the oral and topical methods of administration of the candidate chemosterilants, the following compounds were found to be the most effective: ENT 50,407, 50,838, 50,839, and 50,876. These compounds induced sterility at a wide range of concentrations without toxic effect.

2/ MRT obtained from Marvin R. Thompson, Inc., Stamford, Conn. Mention of commercial products does not necessarily imply their endorsement by the U.S. Department of Agriculture.

3/ McPhail, M., and Guiza, F. E. An oviposition medium for the Mexican fruit fly. J. Econ. Entomol. 49: 570. 1956.

4/ Shaw, J. G., and Riviello, M. Sanchez. Effectiveness of tepa-sterilized Mexican fruit flies released in mango grove. J. Econ. Entomol. 58: 26-28. 1965.

Table 1.--Continued

Monoazirine	1-(p-chlorobenzoyl)= aziridine	50,407	.1	1	PS	5.0	3	PS
			.5, 1.0	1	S	10.0	3	S
			1.5, 2.0	1	TS			
Diazirine	P,P-bis(1-aziridinyl)-N-1,3,4-thiadiazol-2-yl phosphinic amide	50,002	.01	1	N	5.0	3	PS
			.05, .1					
			.25	1	S			
			.5	1	TS			
			1.0	1	T			
	N,N'-(o-phenylenedimethylene)bis(1-aziridine carboxamide)	50,174	.1, .25			5.0	3	PS
			.5, 1.0	1	S	10.0	3	PS
	2,4-bis(1-aziridinyl)-6-methyl-5-nitropyrimidine	50,330	.1, .25			5.0	3	T, PS
			.5, 1.0					
			1.5, 2.0	1	S			
	ethyl [bis(1-aziridinyl) phosphinyl]carbamate	50,450	.1, .25			2.5, 5.0	3	N
			.5	1	S	10.0	3	PS
			1.0, 2.0	1	TS			
	benzyl [bis(1-aziridinyl) phosphinyl]carbamate	50,451	.05, .75	1	S	5.0	3	N
			.1	2	TS			
			1.0, 2.0	1	T			
	P,P-bis(1-aziridinyl)-N-ethyl=phosphinic amide	50,787	.01, .05			5.0	3	TS
			.1, .5	1	S			
			1.0	1	T			
	N,N'-tetramethylene bis (1-aziridinecarboxamide)	50,838	.1, .2	1	N	5.0	3	S
			.3, .5					
			.7	1	S			
			1.0	1	TS			

Table 1.--Comparison of a standard (ENT-24,915, tepa) with the results of 20 compounds on the reproductive capacity of the Mexican fruit fly, when administered orally in neutralized food and topically as a pupal dip. (S = Sterilant (75-100 percent effective); PS = Partial Sterilant (50-75 percent effective); T = Toxicant; TS = Toxicant-Sterilant; N = No effect).

			ORAL			TOPICAL		
Type of compound	Name of compound	ENT No.	Percent concen-tration	No. of replicates	Effect	Percent concen-tration	No. of replicates	Effect
Standard (Triaziridine)	tris-(1-aziridinyl)-phosphine oxide	24,915	.3	3	S	2.5	5	S
			.5	3	S	5.0	5	S
			1.0	3	S			
Nitrogen Mustard	5-[bis(2-chloro-ethyl) amino] uracil	50,439	.1	1	N	5.0	3	PS
			1.0, 1.3			10.0	3	PS
			1.5	1	S			
Nonaziridine	imidodicarboxylic acid dihydrazide	25,007	.1, 1.0	1	N	5.0	3	N
			1.3, 1.5					
			2.0, 3.0	1	S			
			4.0	1	TS			
	5-fluorouracil	25,297	.01, .05	1	S	5.0	3	N
			.1	1	TS			
			1.0	1	T			
	bis(dimethylglyoximato)-bis(ethylenimine)cobalt chloride	50,872	.1, 1.0			5.0	3	N
			1.3, 1.5					
			2.0, 4.0	1	S			
	trans-dichlorotetrakis-(ethylenimine)chromium chloride	50,873	.1	1	N	5.0	3	N
			1.0, 1.5					
			2.0	1	S			
	bis(ethylenediamine)bis-(ethylenimine)cobalt tribromide	50,874	.1	1	N	5.0	3	N
			1.0, 1.3					
			1.5	1	S			

Table 1.--Continued

Diaziridine (Continued)	N,N'-octamethylene bis (1-aziridinecarboxamide)	50,839	.1, .25			5.0	3	S
			.5	1	S			
			.75, 1.0					
			1.5	1	TS			
	N,N'-pentamethylene bis (1-aziridinecarboxamide)	50,840	.1, .25			5.0	3	PS
			.5, 1.0	1	S			
	N,N'-heptamethylene bis (1-aziridinecarboxamide)	50,841	.1	1	N	5.0	3	PS
			.25, .5					
			.7, 1.0	1	S			
	N,N'-(2-methyl-m-phenylene) bis (1-aziridinecarboxamide)	50,842	.1	1	N	5.0	3	PS
			1.0, 1.3					
			1.5	1	S			
	2,4-bis(1-aziridinyl)-6-methylamino-s-triazine	50,876	.1	1	N	5.0	3	S
			.5, .7					
			1.0	1	S			
Triaziridine	N[tris(1-aziridinyl)=phosphoranylidene] benzenesulfonamide	50,845	.1, .25			5.0	3	PS
			.5, .7					
			1.0	1	S			

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